

## CHANGES IN MOBILE MODELING ASSUMPTIONS, 2003 TO 2004

Assumptions underlying highway mobile source modeling have changed in several ways since the modeling for the State Implementation Plan (SIP) for the Atlanta Ozone Nonattainment Area (the "2003 attainment demonstration"), submitted to the United States Environmental Protection Agency (EPA) on October 28, 1999, was completed. The changes include revised data on vehicle registration distribution by age, percent of vehicle miles traveled (VMT) by vehicle type, and speeds.

In addition, there has been a change in the methodology used to estimate highway mobile source emissions inventories and the motor vehicle emission budgets (MVEBs) they establish for transportation conformity purposes. For the 2003 attainment demonstration, EPD used the standard SIP methodology described in section 3.3.5.1 of EPA's "Volume IV" guidance<sup>1</sup> to calculate highway mobile source emissions in the 13-county Atlanta ozone nonattainment area (NAA) and in 30 attainment area counties surrounding the NAA:

"[U]se FHWA's Highway Performance Monitoring System (HPMS) roadway classification scheme to group portions of VMT by the functional classification of the roadways on which they occur. This results in 12 subsets of VMT. Within each subset, speed is weighted by VMT to calculate an average speed...."

For the 2004 attainment demonstration, EPD established the MVEBs using ARC's link-based emissions estimation procedure. Using ARC's link-based procedure enables the mobile source emission inventories in the SIP to be calculated in a manner consistent with federal regulations for performing regional emissions analyses used in transportation conformity determinations. For details of the emissions post-processor used to calculate the MVEBs for the 2004 attainment demonstration, see "Emissions Post-Processor Documentation" elsewhere in Appendix XXXI ([http://www.dnr.state.ga.us/dnr/enviro/ plans\\_files/plans/Emissions\\_Post-Processor.pdf](http://www.dnr.state.ga.us/dnr/enviro/ plans_files/plans/Emissions_Post-Processor.pdf)).

### **Adequacy of MVEBs in 2003 Attainment Demonstration**

On February 15, 2000, EPA found the MVEBs submitted as part of the 2003 attainment demonstration adequate for transportation conformity purposes. The EPA adequacy determination was published in the Federal Register at 65 FR 10490 on February 28, 2000. Subsequently, on June 8, 2000, the Southern Environmental Law Center, on behalf of Georgians for Transportation Alternatives, the Sierra Club, Southern Organizing Committee for Economic and Social Justice, Georgia Coalition for the People's Agenda, and Environmental

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<sup>1</sup> *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources*, EPA-450/4-81-026d, US EPA, Office of Air and Radiation, Office of Mobile Sources, 1992 (<http://www.epa.gov/otaq/inventory/r92009.pdf>)

Defense ("petitioners"), submitted a Petition for Reconsideration of Motor Vehicle Emissions Budgets Adequacy. The petition requested that EPA reconsider and withdraw its adequacy determination of February 15, 2000, stating that since that time, new information had become available and that the modeling for the MVEB should be updated in two areas, vehicle registration data and vehicle speed data. The petitioners alleged that without this updated data, the modeling data was substantially inaccurate and out-of-date, and significantly underestimated mobile source emissions.

### **Development of Revised Registration Distribution by Age**

In keeping with longstanding EPA guidance,<sup>2,3</sup> the local vehicle registration distribution data used for modeling the mobile source emission factors for the 1990 Base Year SIP (90regdis.xls) was also used in calculating 2003 mobile source emissions for the 2003 attainment demonstration.

The petitioners claimed that the vehicle registration data used to develop the MVEBs was out-of-date, and thus that the emissions in the MVEBs were underestimated. The petitioners alleged that there has been a substantial increase since 1990 in the numbers of "higher-polluting" sport utility vehicles and light duty trucks. This allegation reflected an apparent misunderstanding of how registration data is used in mobile source emissions modeling. Local registration data is used solely to determine the relative AGE of the vehicles within each vehicle type, not the NUMBERS of vehicles of a given type. For each of the eight vehicle types for which EPA's MOBILE5b model calculates emission factors, the user enters the percent of all vehicles of that type which are zero-to-one model year old, two model years old, three model years old, etc., up to the oldest category, 25-model-years-and-older. There is no input to MOBILE5b for the number of vehicles of a particular type. However, to address this concern over registration data, EPD had a new vehicle age distribution (99regdis.xls) extracted from the 1999 vehicle registration database received from the Georgia Department of Revenue, Division of Motor Vehicles. The extraction involved designating vehicles in the registration data to MOBILE5b categories using weight, fuel, and general vehicle type. These characteristics were derived in part by decoding the vehicle identification number (VIN), a 17-digit string embedded with codes representing individual vehicle specifications. For details of the development of the

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<sup>2</sup> "All emissions projected for future years should be based on the same inventory methodologies and computational principles as the base year emissions...Using the same methodology ensures consistency in format and content between base year and projection year emissions estimates and prevents possibly spurious inventory differences due to changes in methodology." Procedures for Preparing Emissions Projections, EPA-450/4-91-019, U.S. Environmental Protection Agency, Research Triangle Park, NC, July 1991 (<http://www.epa.gov/ttn/chief/eidocs/proc.zip>).

<sup>3</sup> "If local...registration distributions are used, they normally should not change across calendar years...Modeling that assumes no further aging of the fleet from the current characterization will be accepted by USEPA for SIP purposes....USEPA will not accept modeling for SIP's that includes assumptions that the vehicle fleet will be newer in the future than is reflected in the registration distributions used for the base year emission factors and inventory development." User's Guide to MOBILE5, September 1996, Section 2.2.3.3, p. 2-27 (<http://www.epa.gov/oms/models/mobile5/mob5buse.pdf>).

1999 registration distribution by age, see "Vehicle Registration Records Analysis and Model Year Distribution Report" in Appendix XXXI ([http://www.dnr.state.ga.us/dnr/envIRON/plans\\_files/plans/Registration\\_Distribution.pdf](http://www.dnr.state.ga.us/dnr/envIRON/plans_files/plans/Registration_Distribution.pdf)). Following the report are comments from a consultant to the petitioners and responses to those comments ([http://www.dnr.state.ga.us/dnr/envIRON/plans\\_files/plans/Registration\\_Distribution\\_comments.pdf](http://www.dnr.state.ga.us/dnr/envIRON/plans_files/plans/Registration_Distribution_comments.pdf)). In response to one comment, that there are only 6,031 heavy duty diesel vehicles (HDDVs) among the 3.5 million vehicles in the database and that EPA guidance<sup>4</sup> recommends use of MOBILE defaults in "areas having relatively few local HDDV registrations, but significant interstate trucking activity within the local area," EPD retained the MOBILE5b default registration distribution by age for HDDVs.

For mobile source emissions modeling in the 30 counties within the 43-county Urban Airshed Model (UAM-IV) domain but outside the 13-county Atlanta NAA, the 13-county registration distribution by age was used for the 2003 attainment demonstration on the assumption that the age of the fleet in those counties was closer to that of the Atlanta fleet than to the MOBILE5b default. However, in response to a comment from EPA, the MOBILE5b default (def-reg.xls) was used for the modeling of 2004 mobile source emissions in those 30 counties.

### **Development of Local VMT Mix Percentages**

Perhaps more relevant to the petitioners's concerns about changes in the composition of the fleet in the Atlanta ozone NAA and their effect on the MVEBs is the percentage of total vehicle miles traveled (VMT) by each vehicle type. These "VMT mix" percentages are important elements in determining motor vehicle emissions. The modeling for the 2003 attainment demonstration used the MOBILE5b default VMT mix (see table below; note that the default VMT mix is an output from, not an input to, MOBILE5b), but in the interest of using locality-specific data to the extent possible, MOBILE5b inputs for VMT mixes in each of two areas, the 13-county Atlanta NAA and the 30 counties within the 43-county Urban Airshed Model (UAM-IV) domain but outside the NAA, were developed for the modeling of 2004 mobile source emissions.

Default MOBILE5b VMT mix used for 2003 attainment demonstration:

LDGV	LDGT1	LDGT2	HDGV	LDDV	LDDT	HDDV	MC
0.585	0.197	0.090	0.037	0.002	0.002	0.083	0.003

The most readily available data for VMT by vehicle type are those collected by states and submitted every year to the Federal Highway Administration (FHWA) as part of the Highway Performance Monitoring System (HPMS) program. These data are summarized by state, roadway type (seven<sup>5</sup> of the 12 HPMS functional classifications), and vehicle type (HPMS

<sup>4</sup> User's Guide to MOBILE5, Section 2.2.3.6.

<sup>5</sup> Rural Interstate, Rural Other Principal Arterial, Rural Minor Arterial, Urban Interstate, Urban Other Freeways and Expressways, Urban Principal Arterial, and Urban Minor Arterial

classifications) in FHWA's Highway Statistics Table VM-4. The latest Table VM-4, for 1999, is available here (in Adobe Acrobat format):

<http://www.fhwa.dot.gov/ohim/hs99/tables/vm4.pdf>

and here (in Excel 97 format):

<http://www.fhwa.dot.gov/ohim/hs99/excel/vm4.xls>

The Georgia data from the 1999 Highway Statistics Table VM-4 was used to develop a VMT mix for the 13-county NAA. The VMT distributions for the seven HPMS roadway types in Table VM-4 were weighted together into a single distribution for all roadway types using the summer-adjusted 1999 historic daily VMT on those functional classifications in the Atlanta NAA. See the Excel 97 workbook 99sVMTmx.xls ([http://www.dnr.state.ga.us/dnr/envIRON/plans\\_files/plans/99sVMT.xls](http://www.dnr.state.ga.us/dnr/envIRON/plans_files/plans/99sVMT.xls)) elsewhere in Appendix XXXI for details.

HPMS vehicle types were mapped to MOBILE5b vehicle types using Table 2-1 from the Emission Inventory Improvement Program (EIIP) document "Use of Locality-Specific Transportation Data for the Development of Mobile Source Emission Inventories," available here:

<http://www.epa.gov/ttn/chief/eiip/techreport/volume04/iv02.pdf>

The resulting fractions of total VMT traveled by each vehicle type in the 13-county NAA are shown in the table below:

13-county VMT-weighted<sup>6</sup> Georgia VMT mix:

LDGV	LDGT1	LDGT2	HDGV	LDDV	LDDT	HDDV	MC
0.655	0.160	0.082	0.028	0.009	0.002	0.062	0.002

Similarly, a local VMT mix for the 30 attainment area counties in the 43-county UAM-IV domain outside the NAA was derived from the Georgia data in Table VM-4 by weighting together the VMT distributions for the seven HPMS roadway types in the table using the summer-adjusted 1999 historic daily VMT on those functional classifications in those 30 counties. See the Excel 97 workbook 99Vmx30.xls ([http://www.dnr.state.ga.us/dnr/envIRON/plans\\_files/plans/99sVmx30.xls](http://www.dnr.state.ga.us/dnr/envIRON/plans_files/plans/99sVmx30.xls)) elsewhere in Appendix XXXI for details.

The resulting fractions of total VMT traveled by each vehicle type in the 30 UAM-IV counties outside the NAA are shown in the table below:

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<sup>6</sup> Weighted using summer-adjusted 1999 HPMS VMT for the seven Table VM-4 functional classifications in the 13 Atlanta nonattainment area counties.

30-county VMT-weighted<sup>7</sup> Georgia VMT mix:

LDGV	LDGT1	LDGT2	HDGV	LDDV	LDDT	HDDV	MC
0.638	0.132	0.067	0.047	0.009	0.002	0.103	0.002

### **Nonattainment Area Speed Study**

An Atlanta Nonattainment Area Speed Study was conducted in the fall of 2000 in response to concerns raised by the petitioners, and subsequently by federal agencies reviewing the Regional Transportation Plan (RTP), that the speeds on which the mobile emissions modeling for the SIP and RTP was based were too low. The Georgia Regional Transportation Authority (GRTA), in partnership with the Atlanta Regional Commission (ARC), the Georgia Environmental Protection Division (EPD) and the Georgia Department of Transportation (GDOT), conducted the study to examine current vehicle speeds in the region. Early in 2001, a data analysis team consisting of transportation and air quality professionals from Georgia Institute of Technology and Wilbur Smith Associates was formed to analyze the data from this study and provide recommendations to update vehicle speed information and highway mobile source emissions estimates in Atlanta. For a summary of the approach used by this team, see "Development of Vehicle Speed Parameters For Atlanta Non-Attainment Area Emissions Post-Processor Used in 2004 State Implementation Plan" elsewhere in Appendix XXXI ([http://www.dnr.state.ga.us/dnr/enviro/ plans\\_files/plans/Speed\\_Study.pdf](http://www.dnr.state.ga.us/dnr/enviro/ plans_files/plans/Speed_Study.pdf)). The analysis team's recommendations were incorporated into a revised version of ARC's emissions post-processor, used to calculate emissions from every link in the highway networks in ARC's travel demand model. For details on ARC's emissions post-processor, see "Emissions Post-Processor Documentation" elsewhere in Appendix XXXI ([http://www.dnr.state.ga.us/dnr/enviro/ plans\\_files/plans/Emissions\\_Post-Processor.pdf](http://www.dnr.state.ga.us/dnr/enviro/ plans_files/plans/Emissions_Post-Processor.pdf)).

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<sup>7</sup> Weighted using summer-adjusted 1999 HPMS VMT for the seven Table VM-4 functional classifications in the 30 attainment area counties outside the Atlanta NAA but within the UAM-IV domain.

1990 Base Registration Distribution  
(90regdis.xls)

0.067	0.065	0.072	0.074	0.072	0.068	0.062	0.056	0.046	0.033	LDGV/LDDV---ages 1-10
0.032	0.074	0.065	0.051	0.033	0.026	0.019	0.021	0.015	0.011	LDGV/LDDV---ages 11-20
0.008	0.007	0.005	0.004	0.014						LDGV/LDDV---ages 21-25
0.058	0.066	0.078	0.083	0.078	0.082	0.069	0.057	0.045	0.026	LDGT1/LDDT--ages 1-10
0.024	0.065	0.068	0.040	0.031	0.024	0.015	0.019	0.015	0.012	LDGT1/LDDT--ages 11-20
0.007	0.006	0.007	0.005	0.020						LDGT1/LDDT--ages 21-25
0.058	0.066	0.078	0.083	0.078	0.082	0.069	0.057	0.045	0.026	LDGT2-----ages 1-10
0.024	0.065	0.068	0.040	0.031	0.024	0.015	0.019	0.015	0.012	LDGT2-----ages 11-20
0.007	0.006	0.007	0.005	0.020						LDGT2-----ages 21-25
0.064	0.062	0.071	0.089	0.071	0.069	0.057	0.051	0.043	0.023	HDGV-----ages 1-10
0.020	0.040	0.034	0.036	0.032	0.024	0.027	0.026	0.022	0.018	HDGV-----ages 11-20
0.013	0.014	0.014	0.009	0.071						HDGV-----ages 21-25
0.076	0.077	0.113	0.113	0.090	0.078	0.081	0.068	0.029	0.026	HDDV-----ages 1-10
0.022	0.039	0.033	0.034	0.027	0.011	0.014	0.017	0.014	0.010	HDDV-----ages 11-20
0.007	0.005	0.004	0.003	0.009						HDDV-----ages 21-25
0.008	0.009	0.010	0.013	0.017	0.030	0.030	0.025	0.036	0.055	MC-----ages 1-10
0.037	0.730	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	MC-----ages 11-20
0.000	0.000	0.000	0.000	0.000	0.000	0.000				MC-----ages 21-25

1999 Registration Distribution  
(99regdis.xls)

0.035	0.058	0.066	0.074	0.087	0.071	0.066	0.055	0.054	0.053	LDGV/LDDV---ages 1-10
0.056	0.054	0.049	0.044	0.037	0.029	0.019	0.013	0.011	0.009	LDGV/LDDV---ages 11-20
0.008	0.007	0.005	0.004	0.033						LDGV/LDDV---ages 21-25
0.040	0.093	0.091	0.090	0.087	0.085	0.077	0.053	0.049	0.043	LDGT1/LDDT--ages 1-10
0.049	0.049	0.036	0.032	0.027	0.020	0.013	0.009	0.008	0.004	LDGT1/LDDT--ages 11-20
0.006	0.007	0.006	0.004	0.022						LDGT1/LDDT--ages 21-25
0.098	0.117	0.119	0.108	0.114	0.087	0.047	0.036	0.023	0.029	LDGT2-----ages 1-10
0.033	0.030	0.026	0.029	0.026	0.024	0.016	0.009	0.006	0.002	LDGT2-----ages 11-20
0.006	0.003	0.002	0.002	0.008						LDGT2-----ages 21-25
0.065	0.063	0.083	0.081	0.087	0.069	0.048	0.037	0.031	0.035	HDGV-----ages 1-10
0.042	0.041	0.031	0.042	0.039	0.034	0.022	0.018	0.014	0.013	HDGV-----ages 11-20
0.021	0.015	0.011	0.008	0.053						HDGV-----ages 21-25
0.056	0.053	0.143	0.106	0.123	0.087	0.058	0.032	0.027	0.025	HDDV-----ages 1-10
0.039	0.025	0.024	0.034	0.029	0.022	0.010	0.008	0.001	0.028	HDDV-----ages 11-20
0.022	0.015	0.012	0.006	0.016						HDDV-----ages 21-25
0.032	0.064	0.070	0.074	0.062	0.057	0.052	0.033	0.024	0.023	MC-----ages 1-10
0.023	0.485	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	MC-----ages 11-20
0.000	0.000	0.000	0.000	0.000						MC-----ages 21-25

Default Registration Distribution  
(def-reg.xls)

0.049	0.079	0.083	0.082	0.084	0.081	0.077	0.056	0.050	0.051	LDGV/LDDV---ages 1-10
0.050	0.054	0.047	0.037	0.024	0.019	0.014	0.015	0.011	0.008	LDGV/LDDV---ages 11-20
0.006	0.005	0.004	0.003	0.010						LDGV/LDDV---ages 21-25
0.063	0.084	0.084	0.084	0.084	0.069	0.059	0.044	0.036	0.031	LDGT1/LDDT--ages 1-10
0.030	0.053	0.047	0.046	0.036	0.028	0.017	0.022	0.017	0.014	LDGT1/LDDT--ages 11-20
0.009	0.008	0.008	0.005	0.025						LDGT1/LDDT--ages 21-25
0.054	0.072	0.072	0.072	0.072	0.052	0.050	0.034	0.054	0.031	LDGT2-----ages 1-10
0.028	0.080	0.084	0.049	0.039	0.030	0.018	0.023	0.018	0.015	LDGT2-----ages 11-20
0.009	0.008	0.009	0.006	0.026						LDGT2-----ages 21-25
0.023	0.047	0.047	0.047	0.047	0.038	0.033	0.021	0.026	0.029	HDGV-----ages 1-10
0.034	0.064	0.054	0.058	0.051	0.038	0.043	0.041	0.035	0.029	HDGV-----ages 11-20
0.021	0.022	0.022	0.014	0.117						HDGV-----ages 21-25
0.034	0.067	0.067	0.067	0.067	0.073	0.061	0.040	0.041	0.051	HDDV-----ages 1-10
0.053	0.066	0.055	0.057	0.045	0.019	0.023	0.028	0.024	0.016	HDDV-----ages 11-20
0.011	0.009	0.007	0.005	0.016						HDDV-----ages 21-25
0.144	0.168	0.135	0.109	0.088	0.070	0.056	0.045	0.036	0.029	MC-----ages 1-10
0.023	0.097	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	MC-----ages 11-20
0.000	0.000	0.000	0.000	0.000						MC-----ages 21-25